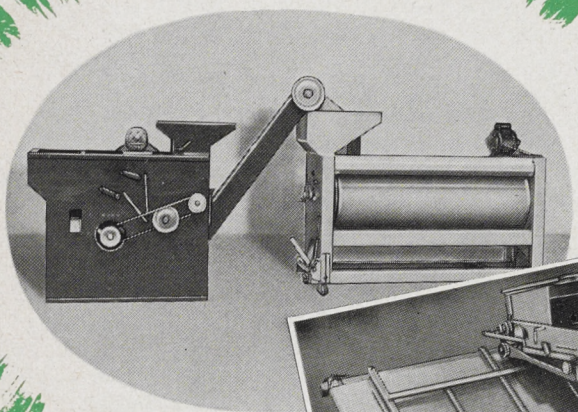
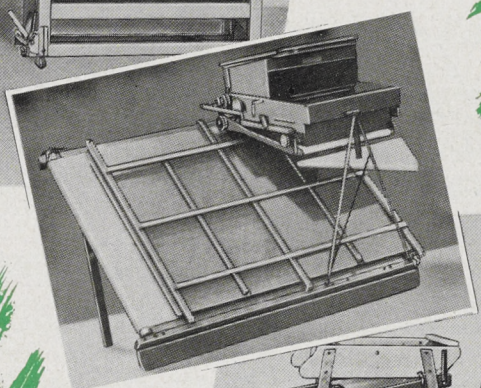
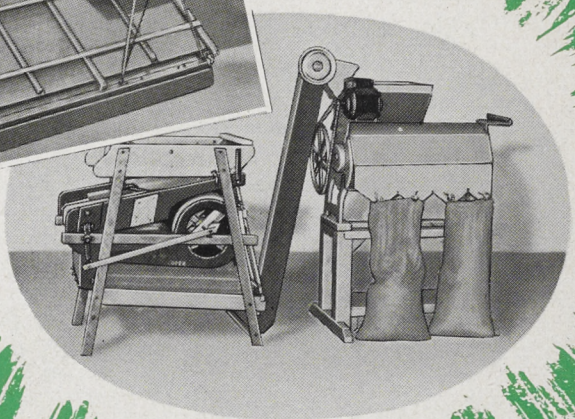
No. 285 FEBRUARY 1956

SEED CLEANING ON THE FARM







By
G. W. HOLMES
Agricultural Engineer

MANITOBA DEPARTMENT OF AGRICULTURE AND IMMIGRATION
WINNIPEG, MANITOBA

By Authority of Hon. R. D. Robertson, Minister of Agriculture and Immigration.
Printed by R. S. Evans, Queen's Printer for the Province of Manitoba.

TABLE OF CONTENTS

Acknowledgments

The author wishes to express appreciation to P. H. Ford, Assistant Director, Soils and Crops Branch, H. M. Lapp, Assistant Professor, Agricultural Engineering Dept., The University of Manitoba; Seed Cleaning Equipment Manufacturers and Distributors, and a number of commercial seed cleaning personnel for information and suggestions in the preparation of this booklet; also, for the use of illustrative material to Hart-Emerson Company Limited, C. C. King & Company Ltd., Forever Industries Limited and Cancade Bros. Limited.

SEED CLEANING ON THE FARM

Clean, sound, viable seed is the first essential to growing a satisfactory grain crop. Seed beds may be well prepared and moisture reserves adequate, but when inferior and weed-polluted seed is used the returns are disappointing. Clean crops mean higher cash returns to the farmer. The control of weeds is one of the most important factors in obtaining the maximum return from grain farming. Weeds increase the cost of production through extra tillage, spraying, and added harvesting costs. Weeds lessen returns through reduced yields, lowered grades and additional freight charges on dockage.

Mature and sound grain, pure as to variety, but containing weed seeds, admixtures of other grains and foreign matter, can usually be made suitable for seed by careful and proper cleaning. On too many farms insufficient attention has been given to thorough cleaning of seed before planting. A Seed Grain Survey, taken in Manitoba in 1955 revealed that only 4% of the samples graded No. 1 seed and 45% graded rejected. Write to the Publications Branch, Manitoba Department of Agriculture, Winnipeg, Manitoba, for a detailed copy of this survey.

METHODS OF SEED CLEANING

Farm

Grain can be cleaned for seed purposes on the farm. However, on the average size farm, to clean small lots, the investment costs for the equipment necessary to make even the more common separations is higher than the farm can support. The large farmer or seed grower can bear the investment of a seed cleaning plant capable of making the majority of separations. Equipment for the more difficult separations is beyond the reach of a farm seed cleaning plant. The usually simpler design and fewer adjustments on farm sized cleaning machines limits its separation efficiency. Machines on most farms do not have as complete range of sieves, screens, disc and indent sizes as required to obtain the desired results under varying conditions. Many farm operators lack sufficient cleaning "know how" as they only clean a few bushels a season. These latter two factors may result in a lower standard of cleaning than the equipment is capable of. According to the 1955 Manitoba Seed Grain Survey only 5% of the samples graded No. 1 seed and 39% graded rejected with farm cleaning plants. This clearly indicates the need for more efficient farm seed cleaning plants or alternative methods of having the seed cleaned.

Custom

Custom seed cleaning plants are the most satisfactory method of having seed cleaned. Only limited use is being made of the custom plants in Manitoba at the present time, however, according to the 1955 Manitoba Seed Grain

Surveys, of the samples cleaned in custom plants 22% graded No. 1 seed and only 15% graded rejected, a decided improvement over the present farm and elevator method of cleaning grain for seed. Custom plants have a wider range of equipment and in addition the equipment is more elaborate resulting in more precise separations. These plants are designed for easy and thorough cleaning to eliminate the possibility of contamination from other "seed lots". An experienced operator is in charge who makes seed cleaning his job and has a full appreciation of most of the problems and the necessary requirements to make even the most difficult separations. Serious consideration should be given in establishing such a plant in grain areas whether it be privately, cooperatively, or municipally owned and operated. If such units are within reasonable driving distance, farmers should avail themselves of this service rather than invest in a unit of their own, and still not be able to make the more difficult separations as they are encountered from time to time.

Elevator

Cleaning equipment in elevators was not installed for cleaning grain for seed purposes and should not be used for such. The equipment was primarily installed for scalping in order to reduce dockage in commercial grain, and is not adequate for seed cleaning. Most installations are difficult to clean thoroughly and mixtures between "seed lots" readily occur. Elevator cleaned grain usually appears well cleaned to the inexperienced eye, but in most instances runs high in the number of small weed seeds it contains. This was clearly brought forth in the 1955 Manitoba Seed Grain Survey where in the elevator cleaned samples, only 1% graded No. 1 seed and 74% graded rejected. In a good many cases, grain, relatively free of weed seeds when brought into the elevator for cleaning, is contaminated in the elevator because of the usually poor clean-out facilities. It is highly recommended that the farmer investigate other methods of having his grain cleaned for seed before using elevator dockage reducing facilities.

PRINCIPLES IN GRAIN CLEANING

Operations

Three operations are fundamental in the grain cleaning process.

SCALPING — Removal of straw, foreign material, dust and chaff.

SCREENING — Removal of weed seeds and broken kernels.

GRADING — Selection of kernels as to size.

Kernel and Weed Seed Characteristics

Machines used for grain cleaning employ three physical characteristics of the kernel itself in accomplishing separations and grading. These are:

LENGTH — Differences in kernel length make it possible for screens, discs, or round indent cylinders to make separations.

WIDTH — Differences in width or diameter make it possible to separate with screens, rolls or width indent cylinders.

DENSITY — Differences in density (weight per unit volume) permit separation of seeds on gravity cleaners or by using an air blast or aspirator (suction).

PARTICULAR CHARACTERISTICS — Such as barbs on wild oats, burrs.

CLEANING PROBLEMS

Each of the cereal grains, legumes and grasses present difficult separations. The kernel characteristics vary with different varieties and seasonal growing conditions and only by actual trials can the proper equipment and settings be found to make the desired separations under existing conditions. The operator must be able to recognize weed seeds and have available references of weed seed characteristics so as to be able to determine the possible methods to use in making some of the more difficult separations. Write the Manitoba Weeds Commission, Manitoba Department of Agriculture, Winnipeg, Manitoba, for information on weed seed characteristics and identification.

The following is a brief general discussion of the methods that may be used to make some of the more difficult separations from various grains. The methods used for the easier separations will be obvious to the operator.

Cereal Grains

WHEAT, BARLEY, RYE

GREAT RAGWEED, ERGOT, PEELED BARLEY and MIXTURES of these grains are the most difficult separations.

GREAT RAGWEED and ERGOT are similar in size to the above cereal grains but can be removed satisfactorily on a gravity table due to their lighter density. A vertical air blast type fanning mill will reduce their number to some extent but cannot be relied upon to do a satisfactory job. In some cases great ragweed can be reduced with a blanket cleaner, as lighter density material does not roll off as quickly as greater density material.

MIXTURES of these grains are very difficult to separate and in most cases the grain cannot be raised to seed standards. Smaller kerneled common wheat may be separated from durum wheat, barley and rye on width and length separations using sieves, screens, Carter disc and indent cylinder by sacrificing the larger kernels of the common wheat or the smaller kernels of the other grains depending on what separations are being made. The larger kerneled common wheat varieties are difficult to separate from these grains but it may be possible to reduce their concentration with the same type of equipment. Removal of barley from wheat and rye can only be completely made on the gravity table. However, under favorable conditions satisfactory separations may be made using width and length separations with rolls, indent cylinder and Carter disc and to some extent sieves and screens, but cannot be depended upon to give the desired results. It is obvious then that mixtures must be avoided to minimize the cleaning problems of these grains.

PEELED BARLEY is almost impossible to remove from wheat and rye as they are nearly the same size and density. Trials using various sieves, screens,

rolls, indent cylinder, Carter disc and gravity cleaner must be made to see which will give the best results on width, length and density separations. The Carter disc or indent cylinder usually gives best results for length separations.

BUCKWHEAT. This small, three-sided seed can be separated with a triangular-shaped opening screen or special buckwheat Carter disc.

WILD OATS, OATS and DEHULLED OATS are scalped by length separation using an indent cylinder or Carter disc. Sieves covered with oilcloth are also effective, the oilcloth keeping the wild oats flat, makes possible scalping on a length separation. Small pin wild oats that may get by the Carter disc or indent cylinder can usually be screened by screens or rolls on width separation — possibly the rolls being more effective.

Oats

WILD OATS and BARLEY are the two most troublesome separations to make from oats.

WILD OATS with awns can be removed satisfactorily with a blanket cleaner. If the awns have been broken off in threshing or handling, they are next to impossible to remove. The pin wild oat and dehulled oats may be screened out with screens, rolls or width indent cylinder on width separation and Carter disc on length separation.

BARLEY, PEELED BARLEY, WHEAT and GREAT RAGWEED are best removed with the Carter disc or indent cylinder using length separation. The larger barley kernels can be scalped with sieves, rolls and width indent cylinder on a width separation.

Flax

LADYS THUMB, DODDER, DARNEL and MUSTARD are the most difficult of the weed seeds to remove.

LADYS THUMB, similar in shape but slightly shorter than flax, can be screened by using a Carter disc. It is also lighter than flax making it possible to be separated by the gravity table.

DODDER, MUSTARD and LAMBSQUARTERS can be screened with rolls and screens using width separation or a Carter disc for length separation. Being round, the mustard may also be removed on spiral gravity.

DARNEL requires a combination of air blast, screens and Carter disc. The lighter portion can be blown out or separated on a gravity table while the heavier seeds may be screened with screens, rolls, indent cylinder or the Carter disc. A blanket cleaner may also be effective under conditions where the darnel has the tendancy to cling.

YELLOW FOXTAIL can be removed by air blast and gravity table. It can also be effectively screened by the Carter disc.

WILD OATS, OATS and DEHULLED OATS are easily scalped with sieves, indent cylinder and Carter disc using a length separation. The gravity table is used to remove broken and dehulled kernels.

SMALL WHEAT may be removed by sieves using the width separation.

SOW THISTLE is blown out with the air blast.

Special Crops

Rapeseed

WILD MUSTARD cannot be removed from rapeseed.

LAMBSQUARTER is almost impossible to separate, but can be reduced in number by sieves and screens. Dehulled lambsquarter is similar in size to the smaller rapeseed.

Peas

MUD particles of similar size present one of the biggest problems but can be separated on the gravity table.

SPLIT PEAS are usually not difficult to screen off but may require more than one run.

GREAT RAGWEED presents no difficulty if the gravity table is used, but is almost impossible to remove otherwise.

Legumes

Alfalfa and Clover

Legume seeds are difficult to clean, as there are a number of similar sized weed seeds requiring special machines to make the separations. Alfalfa and clover being the same size, cannot be separated.

RUSSIAN PIGWEED is one of the most difficult. It is a matter of scalping with sieves and making separations on a gravity table and re-running until the desired tolerance is reached. This means sacrificing considerable legume seed.

LAMBSQUARTER with the husk on is similar in size to legume seed. An air blast and gravity cleaner will help reduce it. Velvet roll is the best in reducing lambsquarter with husks. Some of the smaller seeds may be separated with screens. The lambsquarter seeds with the husks removed can be separated effectively on a spiral gravity. The seeds with husks only partially removed presents more of a problem but may be reduced with a combination spiral gravity and velvet roll.

MUSTARD seed can be separated on a combination of screens, sieves, gravity table and spiral gravity. Those that get by the gravity table can be separated with a velvet roll.

DEHULLED FOXTAIL is practically impossible to separate from legumes as many seeds are the same size, shape and density.

AMERICAN DRAGONHEAD may be scalped with sieves to a certain extent but requires a gravity table or velvet roll or a combination of both for complete separation.

BLADDER CAMPION, NIGHT FLOWERING CATCHFLY and DODDER can be effectively removed with a velvet roll. The percentage of bladder campion and catchfly can be reduced by using a gravity table.

BLACK MEDICK with the hulls on can be scalped with sieves and Carter disc. When the hulls are removed the seed is about the same size and shape as legume seed making separation impossible.

COW COCKLE is easily scalped with sieves and Carter disc.

Grasses

Brome Grass, Intermediate Wheat, Crested Wheat, Slender Wheat, Western Rye, Meadow Fescue.

The problem in grass seeds is the separation of GRASS MIXTURES, QUACK GRASS, OATS and WILD OATS. Separation is effected by a combination of air blast, screens, indent or Carter disc. By using a wheat Carter disc or wheat indent, most of the weed seeds and smaller grain can be eliminated. By choosing screen size and re-running, the operator can make the desired separation according to size. Oats and wild oats can be reduced and possibly eliminated by screens and sieves but is a slow process. If other grasses and quack grass are still present there is no practical way of separating them.

Kentucky Blue Grass

Kentucky blue grass has to be de-fuzzed before being cleaned. This may be done by re-running the blue grass seed through a combine or better still, by passing it through a special paddle machine operated at a high speed.

SOW THISTLE is the problem weed but can be separated on a gravity table. It usually takes more than one run.

The larger grass seeds can be scalped with air blasts, sieves, Carter disc or indent cylinder as Kentucky blue grass is much heavier and smaller.

Timothy

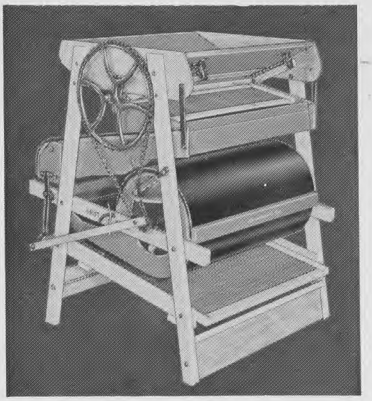
DOG MUSTARD is nearly impossible to separate from timothy.

STINKWEED is also difficult to separate but with screens in combination with a gravity table, satisfactory results can be obtained. Other weed seeds are relatively easy to remove.

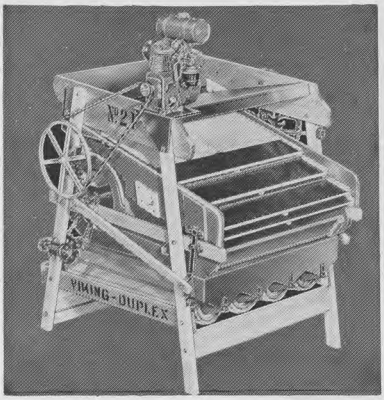
THE FARM SEED CLEANING PLANT

The number and types of machines in the farm seed cleaning plant will depend on the kinds of grain to be cleaned, amount to be cleaned, the common separations to be made, and the availability of custom units.

For the cleaning of cereal grains the **fanning mill** is the basic unit of any farm seed cleaning plant. It is used to do the major portion of the scalping and screening and in some cases the desired degree of cleaning, but usually additional specialized equipment is required. For a small inexpensive farm unit a standard mill proves satisfatory for many of the easier separations.

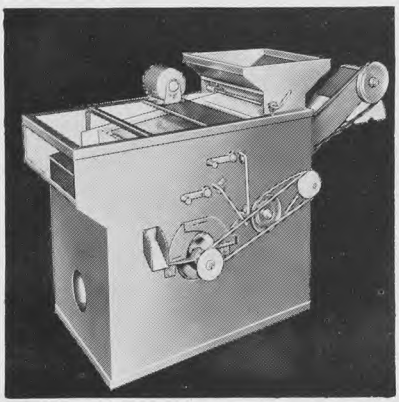


Fanning Mill

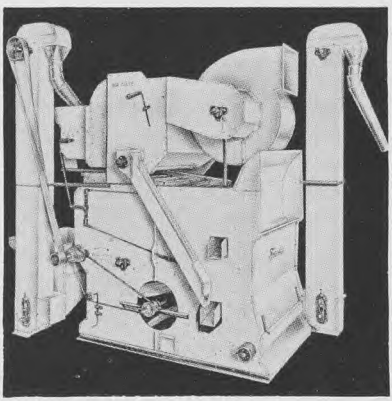


Fanning Mill
(equipped with rolls)

When equipped with corrugated rolls this may do a more effective job, especially on width separations such as pin wild oats from barley and wheat. When larger quantities or custom work warrants additional investment, a fanning mill with a vertical air blast will give better results. These mills are usually equipped with a wider range of adjustments providing a finer degree of control. Fanning mills with a suction or aspirator attachment ahead of the riddle eliminates the dust hazard but adds considerably to the cost. Mills so equipped can be made to do a much better job of cleaning because the major portion of the scalping is being done by the aspirator.



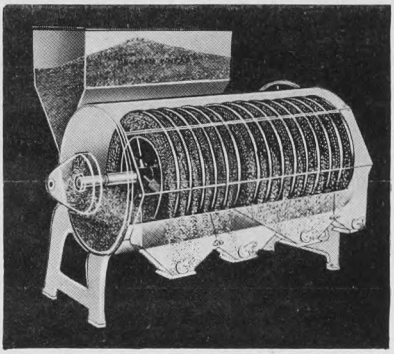
Fanning Mill
(with vertical air blast)



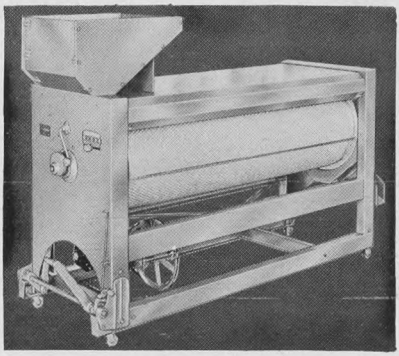
Fanning Mill
(equipped with aspirator)

A fanning mill must be equipped with the proper type and size of sieves and screens to do the desired job of cleaning. A minimum of 3 sets is necessary for each kind of grain to be cleaned to give the operator the selection necessary to do satisfactory work. Many farm operators are hampered by the lack of the necessary range of sieves and screens. These sieves and screens must be selected by trial and if the operator should find the present sizes and types unsuitable others should be purchased. If in doubt as to the requirements, forward a representative sample of the grain to be cleaned, to the company from which the purchase of sieves and screens is to be made and have them suggest the proper requirements.

The next machine to be added to a cleaning unit is a length separator, either a **Carter disc** or an **indent cylinder** to make some of the more difficult separations from wheat, barley, rye and flax. Both do an equally good job **of cleaning but the Carter disc being more versatile, will prove the more**



Carter Disc

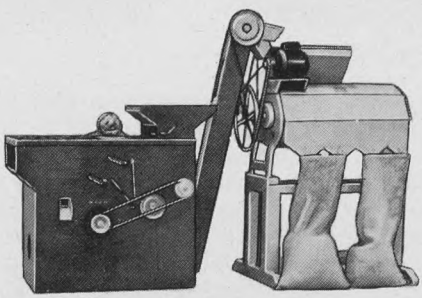


Indent Cylinder

satisfactory. Two or more sizes of discs can be installed in the Carter disc at one time resulting in as many different separations in the one operation. This is particularly desirable when used with the cheaper fanning mills as they may not do as thorough a job as desired. With a single unit indent machine only one separation can be made at a time so it necessitates either a re-run or the use of a more expensive type fanning mill, to ensure the desired separations. A recently developed perforated indent accomplishes screening and scalping in the one operation. If proven satisfactory it will be advantageous over the present indent but will not replace the Carter disc in a farm size plant. This machine is not currently being marketed in a farm size unit.

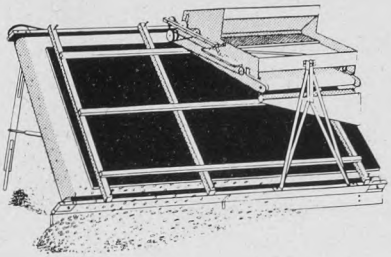
For cereal grains at least one set of discs are required for each of wheat, barley, and flax. As with sieves and screens other sizes of discs may be necessary due to variety and seasonal growing conditions. With the indent cylinder machine, at least one and usually two indent cylinders are required for each of the different grains to be cleaned.

A fanning mill equipped with proper sieves and screens and a Carter disc with suitable discs, makes a practical inexpensive farm seed cleaning unit for the cleaning of most cereal grains when in the hands of a capable operator.



A Suitable Farm Combination

If the wheat, barley, rye and flax to be cleaned presents separations that cannot be made with this combination, it is best to secure a new supply of seed rather than investing in additional specialized equipment.



Blanket Cleaner

A **blanket cleaner** should be added for cleaning oats, which contain wild oats. This machine in combination with the fanning mill and Carter disc will make most of the separations encountered in oat cleaning.

If a Carter disc is not available the blanket cleaner will do an efficient job of removing wild oats from wheat and barley as well. Care has to be taken not to over handle the grain before cleaning so as to break off the awns on the wild oats. It may be better to put the grain over the blanket cleaner first if this were the case. If so, the blanket cleaner should be equipped with a rough scalper to improve the efficiency of the blanket.

Corrugated roll machines make efficient width separation where continuous operation is not of prime importance. There is a tendency for the openings of the rolls to plug, and it will be necessary to stop occasionally for cleaning, otherwise the efficiency is reduced. This machine is used in the grading of barley and in some cases wheat.

For the larger farm cleaning units a **gravity table** may be added but it is doubtful if it is warranted even in the more elaborate units. It is a machine that requires very close and constant attention.

While legume seeds can be cleaned satisfactorily on the farm, the investment for the required machines is within the reach of only a few of the largest growers. A legume seed cleaning unit would require a fanning mill, a Carter disc, a gravity table, spiral gravity and velvet roll. Even a large legume seed grower would need to do a considerable amount of custom work to pay for such an investment.

The larger grass seeds can be easily handled with the same equipment used for cereal grains; the fanning mill and Carter disc or indent cylinder. Kentucky blue grass and timothy require the addition of a gravity table, an investment too high for the average producer.

In planning the farm seed cleaning plant the machines used must be so arranged as to ensure efficiency and ease of operation. Elevator legs from machine to machine and to the bin are necessary for continuous operation. This leaves the operator free to attend the machines. Care should also be given to the ease of cleaning the equipment to prevent mixing when a change-over in grains takes place. When establishing a seed cleaning plant it might be well to consider future expansion. Buy only equipment that fills the present need and which will later fit into the expansion program.

Install machines of similar capacities to provide a balanced unit. In an unbalanced setup the small capacity machine may become overloaded and

result in poor cleaning. It is necessary to keep within the capacity of the machines under the existing cleaning conditions to do efficient work.

A well planned, well constructed, building with the necessary conveniently arranged bins and cleaning area is required. The cleaning equipment should be arranged all on one floor, preferably the ground floor. If installed on the upper floor the building must be particularly well constructed as it is important that vibration be reduced to a minimum. By having the equipment all on the same floor the operator is given a better opportunity for close attention. An overhead bin of 50 bushels or more capacity filled by a leg or small portable auger from the storage bins will provide a convenient continuous flow of grain to the machines. Design the granary with bins of a suitable size for the amounts of grain to be cleaned. One extra bin is required to clean into unless it is to be bagged directly from the machine.

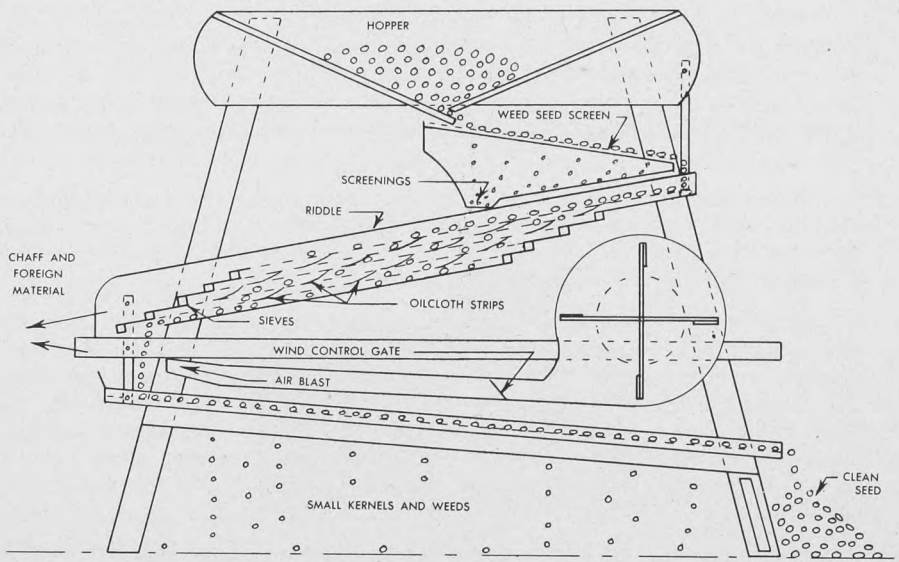
A farm seed cleaning unit equipped with the necessary machines, conveniently arranged, and under the management of a careful and skilled operator will go a long way in improving the standard of seed grain.

FARM SEED CLEANING MACHINES

The Fanning Mill

TYPES

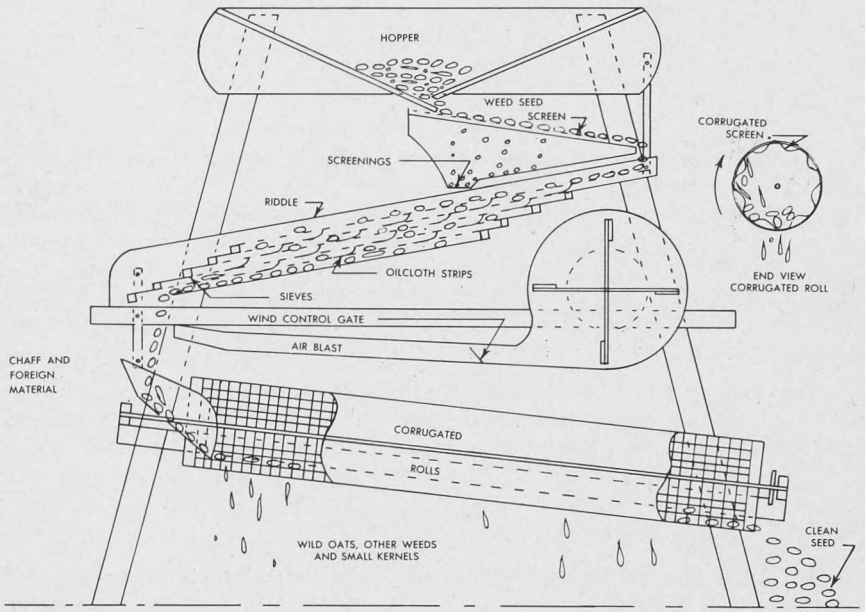
The COMMON FANNING MILL is a general purpose machine suitable for making the easier separations in the cleaning of wheat, oats, barley, rye, flax and grasses. However, it seldom does the desired degree of cleaning and is usually used as a scalping unit. in a more complete plant where specialized equipment is required to make such common difficult separations as wild oats from cereals and separations of mixtures of grains.



Fanning Mill

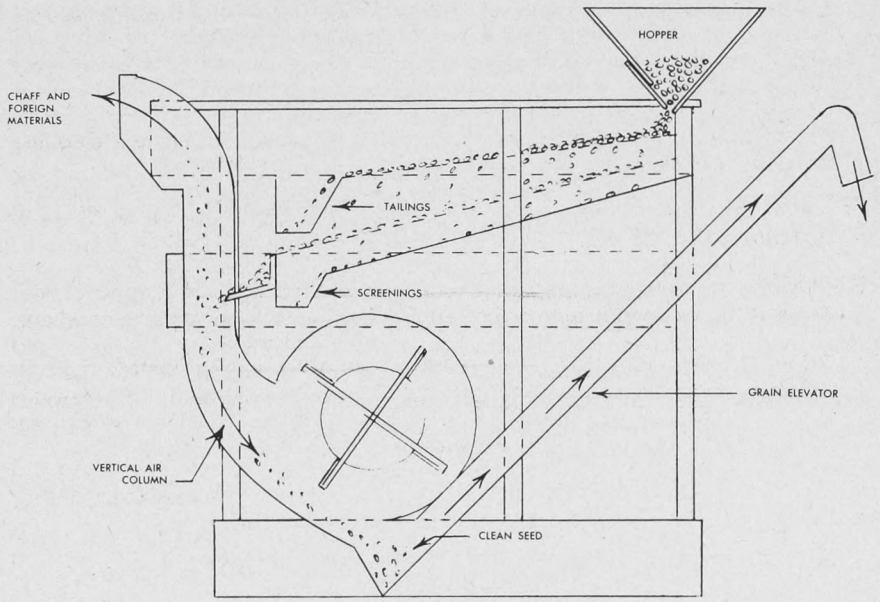
Grain is fed from the hopper to the riddle, which does the scalping and one or more sieves with the size selected according to the variety of the grain being cleaned. Usually the wheat and barley gangs consist of 3 to 6 sieves depending on the difficulty of the separation to be made and whether or not more specialized equipment is being used. With oats and flax only the one scalping sieve is required. As the grain drops from the riddle to the lower screen an air blast removes the lighter material and dust. The riddle and air blast complete the scalping. The lower screen removes weed seeds, small and cracked kernels to complete the screening operation.

A FANNING MILL equipped with CORRUGATED ROLLS in place of a lower screen is more effective in separating wild oats from large wheat and barley and pin wild oats from oats. In operation the kernels are up-ended and the separation is made according to diameter or width. Rolls have the disadvantage of becoming plugged with grain and periodic cleaning is required. In farm cleaning this is not so great a problem as in custom cleaning.



Fanning Mill (equipped with rolls)

The more expensive FANNING MILL is designed with a VERTICAL AIR BLAST. These machines are usually more elaborate as they may be equipped with a double riddle unit, an aspirator, provided with sieve and screen brushes and have a wider range of controls and adjustments. This machine is more effective in making separations, but its limitations are similar to those of the less expensive mills.



Fanning Mill (with vertical air blast)

The vertical air blast is more effective than other air blasts in making separations by density. A high percentage of wild oats can be successfully removed from wheat. However, it cannot be compared to the efficiency of the gravity machine on density separations. When equipped with an aspirator the major portion of the scalpings are drawn off ahead of the riddle, considerably increasing the efficiency of the fanning mill in both capacity and separations being made. The aspirator is a recommended investment where quantities cleaned warrant the extra cost.

The fanning mill is the basic unit of any seed cleaning plant. The type purchased will be dependent on the amount to be cleaned, the cleaning standards desired and what other specialized equipment is to be used.

Operation and Adjustment

To obtain the maximum cleaning efficiency the operator must keep the following points in mind.

1. The mill must be level to permit even passage of the grain over the sieves and screens.
2. Locate the fanning mill a distance from walls, etc. so that it will not interfere with the efficiency of the fan.
3. Minimize vibration by placing the mill on a firm base and bracing it vertically and horizontally.
4. Begin operating at the recommended speed. Slight variations may be necessary under abnormal conditions. Use an adjustable pulley on the motor to make possible proper speed selections.

5. Do not overload the sieves and screens — regulate hopper adjustment.

6. Adjust length of the riddle shake to permit grain to pass uniformly over the sieves.

7. Adjust the slope of the sieves and screens to provide maximum cleaning capacity and efficiency.

8. Adjust the speed of rolls so as not to carry the grain more than ⅝ — ¾ up the side of the roll.

9. Oilcloth may be used on the sieves to keep the kernels flat which will result in better length separation, especially wild oats or oats from wheat.

10. Adjust the amount of wind to remove as many light seeds and kernels as possible. Volume of air blast may be varied by means of control gates or by changing the speed of the fan. Care must be taken not to change the speed of the machine proper when varying the fan speed.

11. Direction of the fan blast may be varied by means of a deflector board. Proper adjustment will be determined by trial and error.

Sieves and Screens

Definition

Sieves and screens differ only in their use — sieves allow desirable grain to pass through and the coarse material to pass over whereas screens retain the desirable grain, allowing the weed seeds and small grain to pass through. Both are referred to as screening material.

Screening Materials

Two kinds of screening material with a variety of opening shapes are commonly used in grain cleaning. They are:

1. **Perforated Zinc Metal**

   (a) Round Openings — diameters of openings measured in 64ths of an inch (e.g. 12 means 12/64") except in a very few cases where actual fractions are used.

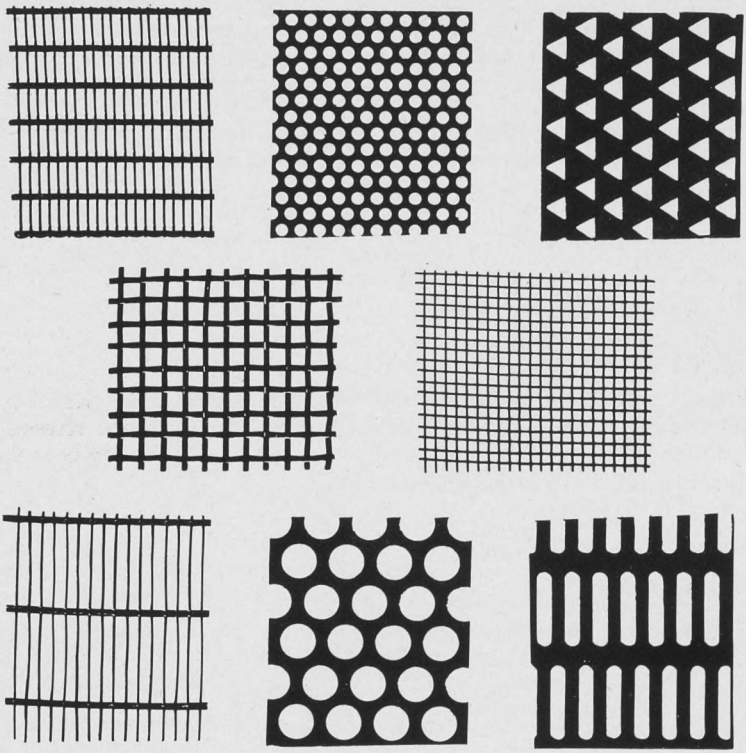
   (b) Oblong Openings — width measured in 64ths of an inch and the length in inches (e.g. 12 x ¾ means 12/64" x ¾").

   (c) Triangular Openings — length of one side of the triangle measured in 64ths of an inch (e.g. 12 means 12/64").

2. Wire

(a) Square Openings — sizes are rated according to the number of openings per inch (e.g. 12 means 12 openings per inch).

(b) Oblong Openings — sizes are rated by the number of openings per inch up to 2 (e.g: 2 x 12 means 2 openings per inch in length and 12 openings per inch in width). When the number of openings are less than 2 per inch the length is designated by the actual length in inches. (e.g. ¾ x 12 means ¾" long and 12 openings per inch in width).



Screening Materials

Recommended Sieve and Screen Sizes

A wide variety of sieve and screen sizes are available. A different selection of sieves and screens both by type and size may be required from year to year depending on seasonal conditions, varieties being cleaned, separations to be made, etc. Selection of sieves and screens is made by trial and necessitates two or three sets for each type of grain to be cleaned.

A partial list of recommended sieve and screen types is given in the following table.

Table 1

COMMON SIZES OF SIEVES, SCREENS AND ROLLS

KIND SEED	TOP SIEVE			LOWER SCREEN		
	TYPE SIEVE	SHAPE OPENING	SIZES USED	TYPE SCREEN	SHAPE OPENING	SIZES USED
WHEAT (Common)	Perforated	Round	12/64", 13/64", 14/64"	Perforated	Round	7/64", 8/64", 9/64"
				Perforated	Oblong	4/64"x½", 4½/64"x½" 5/64"x¾", 5½x¾"
				Perforated	Triangular	5-V, 6-V, 7-V
				Wire	Square	9x9, 10x10, 11x11
				Wire	Oblong	2x10, 2x11, 2x12
WHEAT (Durum)	Perforated	Round	14/64", 15/64", 16/64"	Perforated	Round	8/64", 9/64", 10/64"
				Perforated	Oblong	4½/64x½", 5/64x¾" 5½/64x¾"
				Perforated	Triangular	5-V, 6-V, 7-V
				Wire	Square	8x8, 9x9, 10x10
				Wire	Oblong	2x9, 2x10, 2x11
OATS	Perforated	Round	20/64", 24/64"	Perforated	Oblong	4/64x½", 4½/64x½" 5/64"x¾"
	Perforated	Oblong	8/64"x¾", 9/64"x¾" 11/64"x¾"	Perforated	Triangular	5-V, 6-V, 7-V
				Wire	Square	9x9, 10x10, 11x11, 12x12
	Wire	Oblong	2x5, 2x6, 2x7	Wire	Oblong	2x10, 2x11, 2x12, 2x13
BARLEY	Perforated	Round	16/64", 17/64", 18/64" 20/64", 24/64"	Perforated	Round	8/64", 9/64", 10/64"
				Perforated	Oblong	5/64"x¾", 5½/64"x¾" 6/64"x¾"
	Perforated	Oblong	8/64"x¾", 9/64"x¾" 11/64"x¾"	Wire	Square	8x8, 9x9, 10x10
	Wire	Oblong	¾x5, ¾x6, ¾x7	Wire	Oblong	2x9, 2x10, 2x11
FLAX	Perforated	Round	7/64", 8/64", 9/64"	Perforated	Round	4/64", 4½/64", 5/64" 5½/64"
	Perforated	Oblong	3½/64"x½", 4/64"x½" 4½/64"x½", 5/64"x¾"			
	Wire	Oblong	3x13, 4x14, 4x16	Wire	Square	13x13, 14x14, 15x15
RYE	Perforated	Round	9/64", 10/64", 11/64" 12/64"	Perforated	Round	5/64", 6/64"
				Perforated	Triangular	5-V
	Perforated	Oblong	7/64"x¾", 8/64"x¾"	Wire	Square	11x11, 12x12, 13x13
PEAS	Perforated	Round	16/64", 18/64" 20/64", 22/64", 24/64"	Perforated	Round	8/64", 9/64", 10/64", 12/64"
				Perforated	Oblong	8/64"x¾", 9/64x¾"
				Wire	Oblong	2x5, 2x6, 2x7, 2x8
SUNFLOWER SEED	Perforated	Round	17/64, 18/64, 19/64, 20/64, 22/64, 24/64	Perforated	Round	9/64, 10/64, 11/64, 12/64
BROME GRASS	Perforated	Round	14/64, 15/64, 16/64	Perforated	Round	5/64", 5½/64", 6/64"
	Perforated	Oblong	5½/64x¾", 6/64x¾"	Perforated	Triangular	5-V, 6-V
	Wire	Oblong	2x9, 2x10, 2x11	Wire		Not Recommended
WESTERN RYE GRASS	Perforated	Oblong	4/64"x½", 4½/64"x½" 5/64"x¾", 6/64"x¾"	Perforated	Round	4½/64", 5/64"
	Wire	Oblong	2x10, 2x11, 2x12	Wire		Not Recommended
CRESTED WHEAT GRASS	Perforated	Round	13/64			
	Perforated	Oblong	3/64x½, 3½/64x½ 4/64x½, 4½/64x½,	Perforated	Round	1/18", 4/64"
	Wire	Oblong	3x14	Wire		Not Recommended
ALFALFA AND SWEET CLOVER	Perforated	Round	1/13", 1/14", 1/15"	Perforated	Round	1/18", 1/20", 1/22"
				Wire	Square	18x18, 19x19, 20x20
				Wire	Oblong	4x20, 4x22, 4x24, 6x20 6x21, 6x22, 6x23, 6x24
MILLET SIBERIAN COMMON	Perforated	Round	1/13, 1/14, 1/15	Perforated	Oblong	3/64x½, 3½/64x½
				Perforated	Round	1/18", 1/20"
				Wire	Square	18x18, 19x19, 20x20
MILLET PROSO	Perforated	Round	6/64"	Perforated	Round	4½/64", 5/64", 5½/64"
	Wire	Round	8x8	Wire	Square	12x12, 13x13, 14x14, 15x15
TIMOTHY	Perforated	Round	1/18", 1/20", 1/22"	Wire	Square	28x28", 30x30"
	Wire	Square	19x19, 20x20, 22x22	Wire	Oblong	6x26, 6x32, 6x34
ALSIKE	Perforated	Round	1/18", 1/20", 1/22"	Wire	Square	28x28", 30x30"
	Wire	Square	19x19, 20x20, 22x22	Wire	Oblong	6x32, 6x34

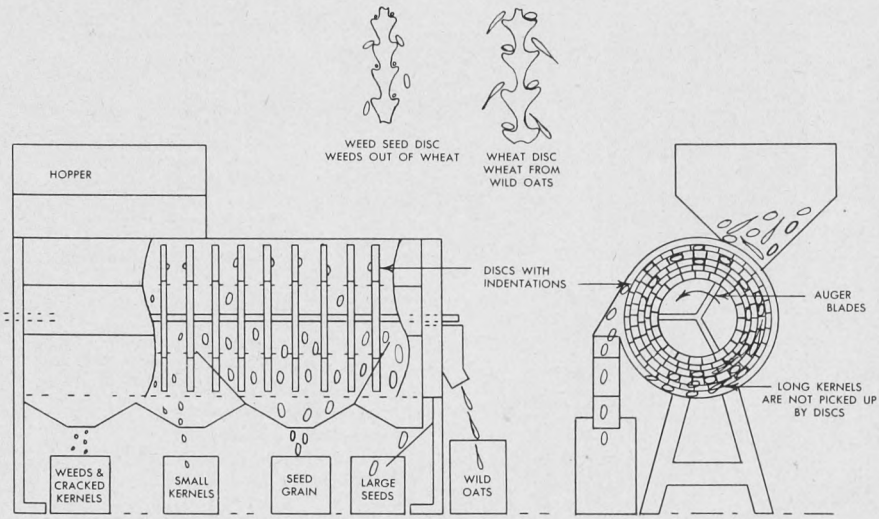
WIRE ROLLS

KIND OF SEED	TYPE OF MATERIAL	SIZE OF ROLL
ABNORMALLY LARGE BARLEY	6 x 6 GALVANIZED WIRE	00
EXCEPTIONALLY LARGE BARLEY	7 x 7 GALVANIZED WIRE	0
LARGE BARLEY	7½x 7½ GALVANIZED WIRE	1
MEDIUM OR NORMAL BARLEY	8 x 8 GALVANIZED WIRE	2
WILD OATS FROM WHEAT	8½x 8½ GALVANIZED WIRE	3
	9 x 9 GALVANIZED WIRE	3½
WILD OATS FROM TAME OATS	8½x 8½ GALVANIZED WIRE	3
	9 x 9 GALVANIZED WIRE	3½
SMALL WHEAT	10 x 10 GALVANIZED WIRE	4
PEAS	JAPANNED WIRE	¾ x 5
		¾ x 6
ALFALFA	ROUND HOLE ZINC	1/18, 1/20
FLAX	ROUND HOLE ZINC	5/64, 5½/64

Table — Courtesy Hart-Emerson Company Ltd.

The Carter Disc

The Carter disc consists of a series of flat discs mounted on a horizontal shaft. The sides of the discs consist of a number of under cut pockets. Separation and grading are accomplished according to length. On farm units the machine is usually equipped with discs of three or four different size pockets. Small pockets pick up the weed seeds, small and cracked kernels, while the larger pockets pick up the longer kernels. Long kernels such as oats, wild oats are not picked up and pass on through the machine. The disc supporting arms are designed to move the seed along the machine. Bagging spouts are suitably arranged along the length of the machine for each separation.



Carter Disc

The Carter disc is a more specialized machine used in conjunction with a fanning mill or scalping unit. It is extensively used in farm grain and legume seed cleaning where length separations are desirable. Common separations include oats and wild oats from wheat and to some extent barley. Refer to Cleaning Problems — Page 3 for other separations.

Operation and Adjustment

1. The machine must be set level and on a firm base.
2. Discs must revolve at recommended speed to obtain best results.
3. As with any seed cleaning machine adjust capacity to give highest cleaning efficiency.
4. Select proper pocket size for desired results.

Discs

Carter discs are available in a number of pocket sizes. The following table lists pocket sizes and their applications.

Table 2

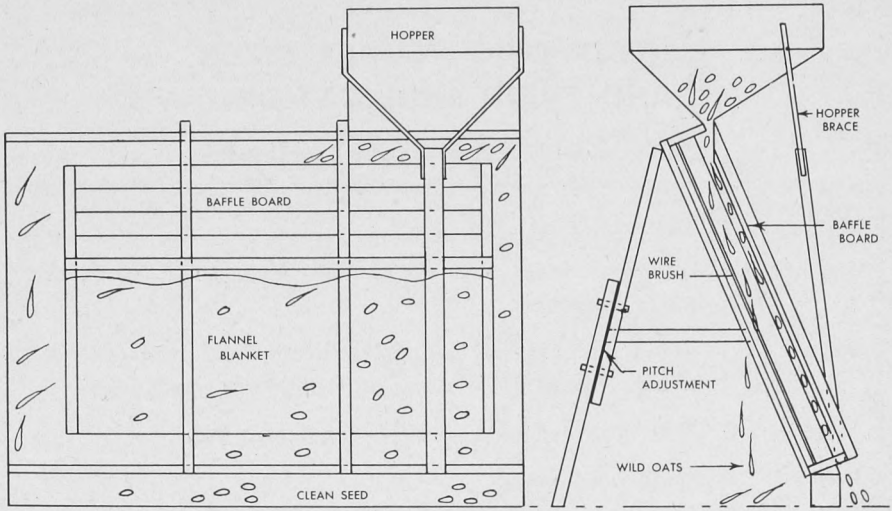
CARTER DISC POCKET SIZES AND THEIR APPLICATION

(In Order Of Size From Smallest To Largest)

POCKET SIZE	USE
V-4	For lifting weed seeds out of flax. Very small pig weed, lady's thumb, etc.
V-5	Weed seed disc for lifting the small weed seeds out of wheat. Mustard and seeds larger than pig weed.
V-5½	Picks out weed seeds a bit larger than a V-5.
V-6	Small weed seeds.
Q	Weed seed disc. Not commonly used.
N	Standard weed disc, for picking out all average size weed seeds including buckwheat.
NJ	Splitting disc — "N" on one side, "J" on the other side.
K	For picking flax out of wheat and any extra large weed seeds that "N" cannot handle.
C	For lifting small wheat.
EE	Wheat disc for small and medium size common wheat.
J	Standard disc for common wheat.
A	Commonly used for Durum and small barley or exceptionally large wheat.
B	Barley disc.

The Blanket Cleaner

The blanket cleaner consists of one or more horizontal or vertical revolving blankets on a sharp incline. It may or may not be equipped with a scalping attachment. The grain may be fed onto the blanket at an upper corner or along the top depending on the machine. The smooth kernels roll down the surface of the blanket falling free, while those that possess properties which cause them to cling to the blanket are carried around, thus making the separation. Separation can also be made where there are considerable differences in densities of the seeds. The denser material will roll off the blanket sooner. Kernels clinging to the blanket are brushed free usually by a tight wire rubbing against the surface of the blanket.



Blanket Cleaner

Some of the more common separations include wild oats and burrs from seed grains. The appendages that provide the clinging ability are sometimes removed in scalping and screening operation. If this is the case it may be best to use the blanket cleaner ahead of other cleaning equipment. This is only possible when the seed is relatively clean. Grain to be cleaned on a blanket machine should be handled as little as possible prior to cleaning to minimize the breaking off of these clinging appendages.

Operation and Adjustment

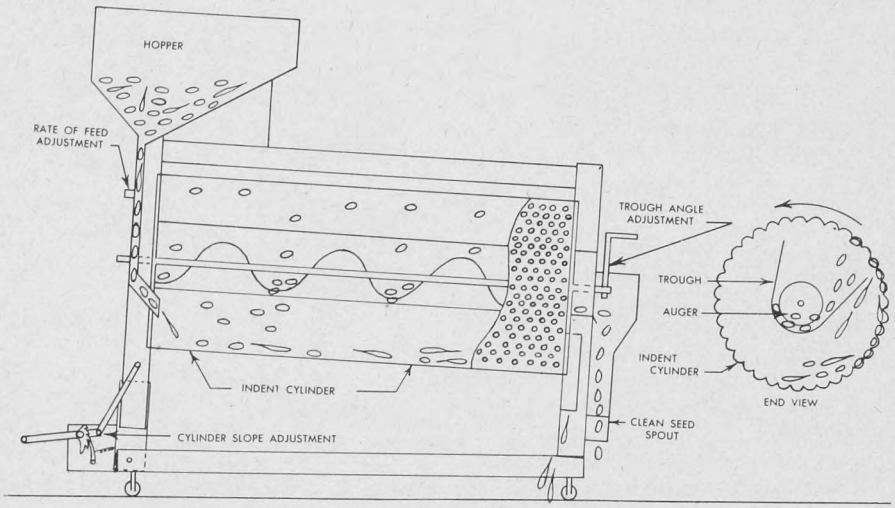
1. The slope of the blanket to facilitate the separations of the clinging and non-clinging material.
2. The tension of the blanket to ensure positive drive and non wrinkle operation.
3. The speed to obtain maximum cleaning efficiency.
4. Adjust the variable diameter pulley so that the top and bottom of the blanket will be driven at the same speed.
5. The baffle board clearance adjusted from ¼ — 2" depending on the grain — to prevent the clinging grain from bouncing and rolling off the blanket too quickly.
6. Adjust rate of feeding for maximum efficiency and capacity.

The Indent Cylinder

The indent cylinder is a relatively new machine for farm use. It consists of a revolving indented drum or cylinder which lifts weed seeds, and grains up to the size the indent is designed for, dropping them into a trough where they are augered out. Two types of cylinders in various sizes are available. Round pockets or indents make separations on the length basis similar to the

Carter disc. A special cylinder grooved lengthwise is suitable for width or diameter separation. Grains longer or wider than those the indent is designed for, pass through without being picked up. The position of the trough is adjustable for finer selection. In a one-cylinder unit only one separation can be made at a time as each cylinder consists of only one size indents or grooves. Two runs or a double cylinder unit is required if screening and scalping is to be done. This is a disadvantage as compared to the Carter disc for a farm plant. Additional cylinders are cheaper than additional sets of discs.

A recently developed cylinder consists of a perforated indent which accomplishes screenings as well. The grooved indent has slot perforations for width separation while the round indent has round perforations for diameter separations. If proven satisfactory this drum will have the advantage of scalping and screening in the one operation. However, it is doubtful if the efficient cleaning of the Carter disc will be obtained. The capacity will be considerably reduced from the present indents.



Indent Cylinder

The round indent makes separations similar to those of the Carter disc while the width indent separates wild oats from barley and pin wild oats from oats. The trough position adjustment allows for a closer degree of separation and takes care of a wider range of conditions.

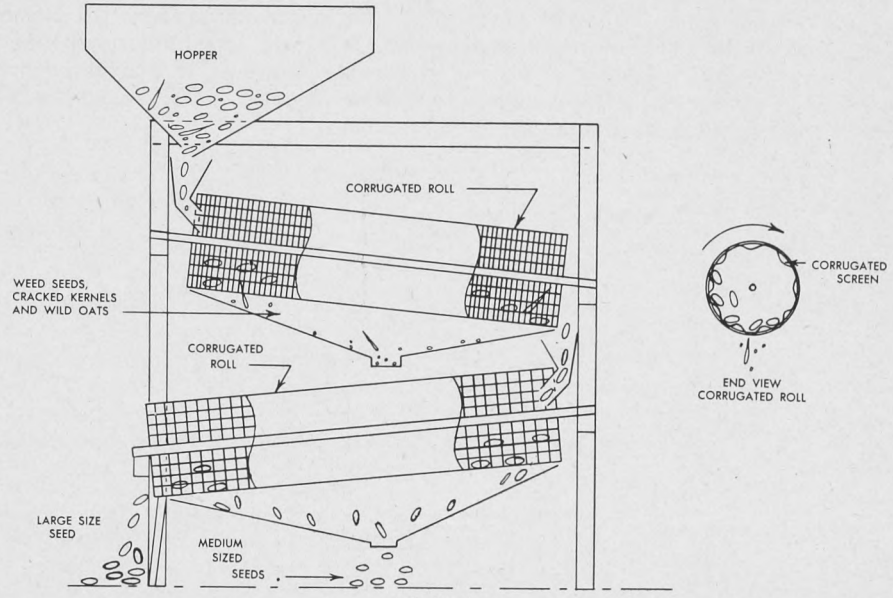
Operation and Adjustment

1. The cylinder must revolve at the recommended r.p.m. for satisfactory results.
2. Adjust the trough angle to make the desired separations so as not to sacrifice too much good grain.
3. Select indent sizes according to size and types of separations to be made.
4. Adjust the incline of the cylinder to control the rate of grain passing through the cylinder.

Other Specialized Machines

The Corrugated Roll Grader

The Corrugated roll grader consists of a series of corrugated rolls — each mounted on an alternate incline so the grain passes through two or more series. The screen size is larger in each successive series. Each succeeding series remove the smaller kernels until the cleaning and grading operations are complete. In operation the kernels are up-ended resulting in separation by width or diameter of the kernels. The number of series used will determine the degree of grading. A scalping unit must be used in series with this machine.



Roll Grader

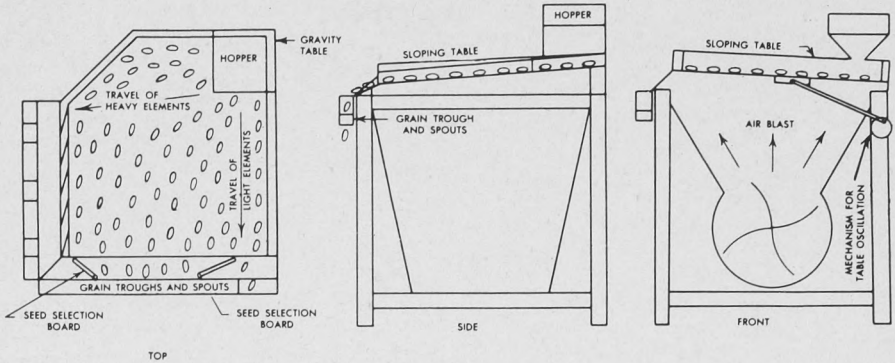
The Corrugated roll grader is primarily a screening and barley grading machine. It does an efficient job of width separation such as pin wild oats from wheat and barley. Refer to Cleaning Problems Page 3 for further separations.

Adjustments include the proper speed and slope of rolls. The speed will vary slightly but in most cases the kernels should be carried only ⅔ — ¾ up the side of the roll. If excessive speed is used the kernels will be carried around by centrifugal force. Keep the rolls cleaned of trapped kernels for efficient work.

The Gravity Table

The gravity table consists of a fan directing an air blast upward through an oscillating perforated table mounted on an incline. The table covering may be either fabric (for legumes) or perforated metal screen (for cereal grains). The grain is fed onto the upper corner of the table and tends to be lifted by the air blast. The heavier density material remains on the table longer and is moved in the general direction of the oscillation while the lighter

density material rolls down the incline. The material consisting of a variety of densities can be separated by suitable arranged spouts at the base of the table.

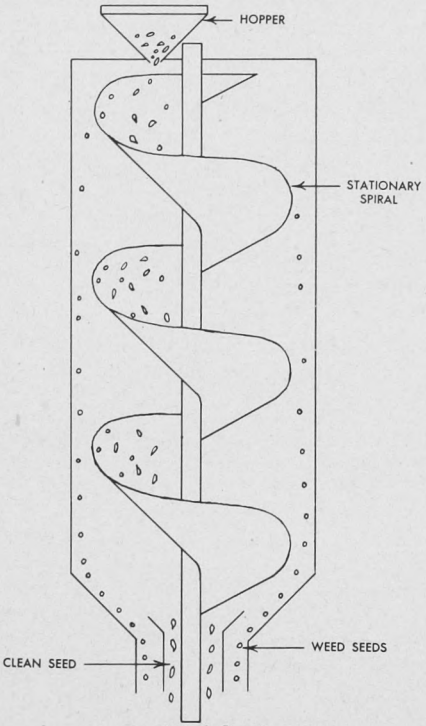


Gravity Table

The gravity table is principally used in commercial seed cleaning plants for separations such as wheat from barley, great ragweed, and ergot from wheat and barley. Refer to Cleaning Problems — Page 3 for other separations.

The adjustments include the incline of the table, amount of air through the table and rate of oscillation.

THE SPIRAL GRAVITY



Spiral Gravity

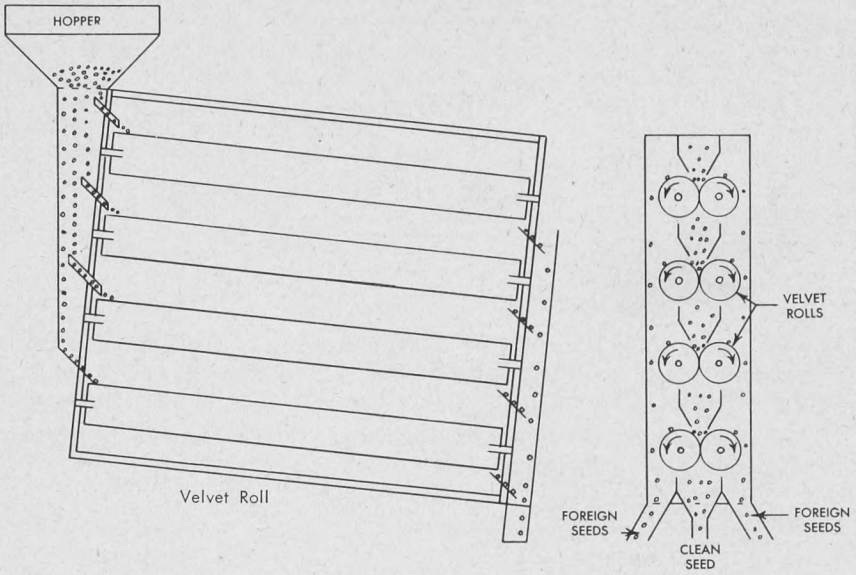
The spiral gravity consists of one large diameter outer spiral or outer cylinder and one or a series of smaller diameter inner spirals — all parallel to each other. They are arranged vertically and remain stationary in operation. Grain is fed at the top of the inner spirals and flows down the spiral due to the force of gravity. Centrifugal force causes the smooth round kernels to roll to the outside of the inner spiral, where it drops free and is caught by the outer spiral or cylinder. Heavier round kernels are the first to roll to the outside of the inner spiral.

The spiral gravity is mainly used in legume seed cleaning particularly where mustard is to be removed. Refer to Cleaning Problems — Page 5 for other separations.

The rate of feed is the only adjustment required.

THE VELVET ROLL CLEANER

This cleaner consists of a series of velvet rolls mounted in pairs side by side on an incline revolving in opposite directions. The grain is fed between the rolls at the elevated end of the incline. Seeds with a clinging characteristic to velvet will be carried free from desired seed as it travels down the incline. Clean seed is received at the lower end of the rolls.



The velvet roll cleaner or "dodder cleaner" is used in legume seed cleaning in removing weed seeds, dodder, bladder campion and night flowering catchfly. The speed and slope of rolls must be adjusted for the desired separations.

CARE OF GRAIN CLEANING EQUIPMENT

All grain cleaning equipment should be housed and kept in good repair. Many machines have wooden parts which deteriorate rapidly if exposed to the weather. Any oscillating machines should be firmly braced when in operation to avoid excess vibration.

Sieves and screens are not rigidly built, so should be stored carefully in a dry place to avoid mechanical injury and rusting. Sieves and screens either rusted or damaged make efficient cleaning impossible.

Operating speeds of machines should be carefully controlled and kept within the manufacturers' recommendations. The following rules may be applied to determine the correct sizes of pulleys to use in operating a machine at a desired speed.

1. Diameter of driven pulley $= \frac{\text{r.p.m. of driving pulley x diameter of driving pulley}}{\text{r.p.m. of driven pulley}}$

2. Diameter of driving pulley $= \frac{\text{r.p.m. of driven pulley x diameter of driven pulley}}{\text{r.p.m. of driving pulley}}$

Whenever the airblast is changed by increasing or decreasing the fan speed, the pulleys should be adjusted so that the machine speed or the speed of any other part of the machine will not be altered.

Carefully follow manufacturers' recommendations for lubrication.